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The Promise and Challenge of Activity-Based Crime Rates: a Comparison of the USA, Canada, and Australia

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Abstract

Alternatives to population-based crime rates were first introduced in 1965. *Activity-based crime rates* derive numerator data from activity-specific crime events, then match these to time spent in the same activities. Activity-based rates can produce a vastly different picture of risk, not captured by population-based rates. Given that numerator and denominator data may be drawn from different sources using different methods, these rates can create a matching challenge. Yet, dramatic results justify that effort. This paper offers new activity-based crime rate calculations for Canada and Australia, then relates these to prior estimates in the USA. Despite data variations among the three nations, activity-based crime rates give us an overall understanding of crime risk not captured by population-based rates.

Keywords Exposure to risk · Alternative crime rates · Routine activities · Environmental criminology

Introduction

Traditionally, population-based rates have been used to measure crime and compare trends across different countries throughout the world. It has long been recognized by criminal justice scholars (Harries 1981; Ratcliffe 2010; Sparks 1980; Stipak 1988), however, that relying on these rates to measure crime and victimization can actually be misleading. The main critique of using the residential population as the denominator in constructing rates is that it does not accurately account for differences in the population's exposure to victimization risk for different types of crimes. To try and mitigate this limitation, it has been suggested that researchers very carefully choose denominators when describing victimization risk using rates

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(Lemieux and Felson 2012). As such, scholars have used different denominators to suggest alternative rates that improve upon the current crime rate per residential population regime to round out our knowledge of where risk is found, and, as a result, inform us of where resources should be directed to mitigate that risk.

The Influence of Boggs on Subsequent Research

Over a half-century has passed since Sarah Boggs (1965) offered the first alternative crime rates, based not on resident population but on more direct measures of exposure to risk. Boggs persuasively argued that conventional population-based rates were often inappropriate for measuring crime risk because they did not consider variations in the environmental opportunities available for different crime types. For example, she recommended that auto-theft rates should be calculated in terms of the number of automobiles exposed to risk of being stolen (see also Gould 1969).

Boggs (1965) recognized that business sections of the city tend to have few residents but large numbers of crime targets, including merchandise on display, untended cars, and people on the streets. Conventional crime rates therefore give a misleading impression that residents of the business district are more criminally inclined than other people. Lacking a daytime census of population walking on sidewalks, Boggs estimated the risk of highway robbery by placing in the denominator the number of square feet of streets in each census tract. She estimated the risk that businesses will be robbed or burgled by entering "business to residential land-use ratio" into the denominators of these rates. Boggs also demonstrated that crime rates using these new denominators completely reversed the crime ranking of certain census tracts compared with using conventional crime rates. Her demonstration influenced several subsequent research efforts, as we note below.

Reconsideration of rates is not merely a methodological issue; it is central to how we *think* about crime risk. Several early commentators and researchers understood this well, advocating for more direct measurement of exposure to crime victimization risk (Clarke 1984; Gottfredson 1981; Harries 1981; Hindelang et al. 1978; Stafford and Galle 1984). Partial remedies included Gottfredson and Grande-Bretagne's (1984) use of nights per week outside the home to predict victimization. This is especially relevant because many criminal acts occur away from where offenders and victims live (Andresen et al. 2014; Felson and Boivin 2015; Groff and McEwen 2007). As a continuation of Boggs' (1965) work and that of more recent researchers, the current study examines how the risk of violent victimization varies as a function of the amount of *time* individuals spend engaged in different activities. To further extend this knowledge base, we also investigate how these findings compare across nations. Our international illustrations are provided mainly for heuristic purposes and are not meant to be direct comparisons among nations.

Non-residential Impact on Crime Rates

It was once common for criminologists to state that the greatest dangers for crime victimization were found at home. However, that observation did not consider time spent at home in comparison to other places. Cohen and Felson (1979) noted time use data showing that people of the USA then spent an average of 16.3 h per day at home, 1.4 h on streets and in parks, and 6.4 h in "other" places. They used those data to calculate crime risk in homes, streets, and elsewhere per billion person-hours exposed to risk. On an hour-for-hour basis, the risk of

assault by a stranger on the street was 25 times greater than the risk of assault by a non-stranger at home. That calculation was extremely relevant to routine activity theory, also providing the first published demonstration that crime rates based on places, activities, or situations can reverse the impression given by conventional rates based on population.

The second publication of hour-based crime risk was offered by Clarke and Mayhew (1998). The British victimization survey had asked each victim of car theft where that vehicle had been parked at the time it was stolen. The same survey asked how much time respondents parked their cars in these locations, keeping location categories consistent. They found that cars parked in a personal garage at home have the least risk of being stolen (2 crimes per 2.4 million car-hours parked at this location). That risk increases by a factor of 20 when a car is placed in a carport or driveway. Moreover, the risk is 160 times greater on a public street compared with that on a personal garage. Hour-for-hour, parking a car at a public parking lot is well over 200 times riskier than parking it in one's own garage. Unlike the Cohen and Felson (1979) calculations, Clarke and Mayhew (1998) obtained both numerator and denominator data from the same survey respondents and used the same place terminology. That was a rare opportunity, unfortunately not often repeated in other activity-based crime rate calculations. Others have used diary data to measure crime risk or risky lifestyles (Felson and Gottfredson 1984; Hoeben et al. 2014), with increasing focus on time allocations during adolescent years.

Risks During Adolescence

A growing literature also calculates crime participation and youth delinquency using in the denominator "time spent in unstructured activities," taking into account the absence of adults and presence of peers (Hoeben and Weerman 2014; Osgood and Anderson 2004). That literature draws from Felson and Gottfredson (1984) and, more generally, the routine activity approach and its focus on more specific exposures to risk of offending and victimization. Each of these studies offers guidance to policymakers in how to focus prevention efforts. Further details in matching numerator and denominator become very important for understanding risk and for focusing crime control resources.

In recent years, scholars have continued to recognize the importance of temporal information for crime and victimization. Although residential population continues to be the most used denominator in crime rate calculations, researchers increasingly recognize that offenders and victims of crime may go beyond their residential zone. For instance, Ruiter and Bernasco (2018, p. 8) used transportation data (e.g., private car, open air private, and public transport) to suggest that "victimization is elevated during travel, and…that travel mode further differentiates victimization risk." Adjustments to denominators have been made using other forms of data to account for ambient populations. In some cases, large transportation survey data has been utilized (Boivin and Felson 2018). Several studies by Malleson and Andresen (Malleson and Andresen 2015a; Malleson and Andresen 2015b; Malleson and Andresen 2016) employ social media data to study how mobile populations influence crime rates over metropolitan space.

Whatever the source of denominator data, time-adjusted crime rates can inform criminal justice analysts about high-risk situations. In his dissertation, Lemieux (2010) highlights the importance of exposure time to victimization and other injuries. For example, when measuring the number of accidents per million persons, riding a bicycle is more than eight times riskier than using an electric hedge-trimmer. However,

considering time spent in these two activities gives a very different impression of risk. The risk of injury from using an electric hedge-trimmer was five times greater per million person hours spent in this activity, compared with riding a bicycle for the same amount of time, a reversal of the conclusion drawn from population-based rates. From time-based fatality data, Lemieux's review showed that skydiving is 500 times riskier, hour-for-hour, than bicycling—a finding that would have been lost without bringing time into the denominator when calculating rates. Such calculations gave epidemiologists a different perspective on risk of injury for activities that diverge greatly in amount of time exposed to risk. Such epidemiological detail—separating risks of specific sports from one another—produces additional understanding that is obscured by less-specific rates with less-specific denominators. This extra understanding requires making both numerator and denominator more specific, then matching one to the other.

Accordingly, Lemieux (2010) calculated activity-based crime victimization risks for the USA.[1] Using the data from the National Crime Victimization Survey (NCVS) (United Stated Department of Justice 2008) matched with the American Time Use Survey (ATUS) (United States Bureau of Labor Statistics 2003), Lemieux (2010) found that time-adjusted victimization rates can be drastically different from their raw crime-rate counterpart. His methodological approach was disaggregated to several demographic and regional subgroups and to different types of violent crime. In all cases, the basic finding is strongly supported. Lemieux and Felson (2012) replicated that finding for twice as many cases, again confirming that activity-based rates not only reveal very strong differences in risk of violent victimization but also depart greatly from population-based rates. Lemieux (2015) extended the data farther to include the years 2003 through 2008, producing a very large population base, corroborating the prior conclusions.

Aim of the Study

Rather than studying hour-of-day variations in crime risk, the current study uses *summary time* spent in each activity, examining the risk of victimization during the hours engaged in that activity. This study also considers whether activity-based crime rates can be calculated in different nations and whether partial comparisons among them for heuristic purposes are fruitful. The current study deals with existing data collected for other purposes, with each of the three countries analyzed—the USA, Canada, and Australia—using different methods. Even within each country, numerator and denominator data were not collected using consistent rules. One of the tasks of this study is to check our ability to reconcile these differences and to calculate meaningful estimates given what is available. Matching problems notwithstanding, this paper looks beyond the methodology itself by considering how activity-based rates can produce different impressions of crime risk within countries, as well as an alternative basis for making comparisons between countries or between regions of the same nation.

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[1] Some researchers may prefer to use the term "time-based rate," and others may prefer "activity-based rate." If the denominator includes "time spent in a given activity," either term serves the descriptive purpose. If the denominator includes "time spent in a given place," it is probably not far off the mark to use "activity-based rate," given that location often implies a type of activity.

Methodology

The current study focuses on activity-based crime rates, namely those rates calculated based on the aggregate amount of time engaged in an activity and thus exposing people to risk of victimization while so engaged. The general equation for an activity-based rate is

$$Activity-Based\ Rate = \frac{(\#of\ adverse\ outcomes\ reported\ in\ a\ place\ or\ activity)}{(Time\ spent\ in\ that\ place\ or\ activity)}$$

Activity-based rates pose three special measurement challenges:

1) To find adequate crime or victimization data disaggregated by activity at the time of the crime event or other information on crime circumstances;
2) To find adequate data measuring how much time people spend in these activities, places, or circumstances; and then,
3) To match those data to crime events occurring in the same circumstances.

For example, a useful police database might include data on number of assaults occurring at home. A useful time budget study might measure the number of hours spent at home. If the two can be matched, that might allow the researcher to calculate the risk of being assaulted at home relative to the hours spent at home. Exactly such a calculation was made in Cohen and Felson (1979).

The person-hour is a useful measure for determining the amount of time one spends on a specific activity or in a particular place. For example, 100 persons each spending 100 h per week at home reflect a total of 10,000 person-hours at home. Victimizations occurring at home can then be divided by time spent at home to produce an activity-based victimization rate. Activity-based rates that are derived using time in the denominator can lead to different conclusions regarding victimization risk, especially if the proportion of victimizations occurring in each place or activity is disproportionate to the amount of time spent in those places or on those activities.

Data

The common thread for the USA, Canada, and Australia is using "person-hours spent in each activity" as the denominator, with crime events classified by activity for numerator data. The term "activity" is used broadly to include places that imply activity exposures. For all three nations, data collected for other purposes were re-purposed for the current research, with some advantages and some disadvantages. Data were retrieved for each country between the years of 2003 and 2008 to facilitate interjurisdictional comparisons. For convenience, the time-based rates for all three countries are presented in "one billion person-hours" in the denominator.

The USA

Existing research by Lemieux (2010) highlights the utility of calculating activity-based risks in the USA. To calculate these rates from 2003 to 2005, two datasets were used: the NCVS as the numerator and the ATUS as the denominator. The NCVS is a self-reported survey that is used

to estimate the incidence and characteristics of criminal victimization (both reported and unreported to law enforcement agencies) in the USA. The ATUS provides an overview of the types of activities, places, and with whom people of the USA spend their time (United States Bureau of Labor Statistics 2003).

Nine activity categories offered in the NCVS were matched to a much larger number of categories in the ATUS. This effort was not straightforward as it required several approximations. More specifically, the calculation of activity-based rates usually requires the researcher to reconcile discrepancies between numerator and denominator data. Categories of activities were not identical but were close enough to harmonize so that the numerator and denominator would apply as closely as possible to the same activity. That required collapsing several ATUS codes into the nine location categories of the NCVS. For example, similar to Lemieux's (2010) study, the numerous home activities detailed by the ATUS were subsumed under two categories: "sleeping (at home)" and "other activities at home." This allowed for 99.8% of the original ATUS data to be matched to the NCVS categories. Thus, to get the denominator in terms of person-hours shopping, as was done in previous studies (Cohen and Felson 1979; Lemieux and Felson 2012), the population of shopping participants was multiplied by the average time spent shopping per participant per day. That product was then multiplied by 365 to estimate the amount of time persons spent shopping during an entire year. That number was divided into the number of violent victimizations occurring while shopping, and that result was then multiplied by one billion to obtain the risk of violent victimization per billion person-hours engaged in shopping. This routine was applied for all nine major activities. Unfortunately, time spent in drinking establishments or drinking activities was not separated by the NCVS; however, a larger category of leisure away from home is included. Similar to Lemieux (2010), violent victimizations were the focus since offenders were likely to know what they were doing at the time of victimization. In contrast, thefts are often discovered with a considerable time lag, making it more difficult for victims to ascertain where the theft occurred.

Canada

Activity-based crime rates for Canada were collected for 2004–2005, through two waves of Canada's General Social Survey (GSS: Statistics Canada 2005a; Statistics Canada 2005b). The GSS program began in the mid-1980s and is administered by Statistics Canada to collect an array of social information through telephone surveys in all ten Canadian provinces. Unfortunately, raw data are only available to researchers on a limited basis. The time use and victimization parts of Canada's GSS were collected at different times, using different survey classifications of place and activity. Fortunately, the published reports of victimization (Statistics Canada 2005a) (see pages 637–640) and of time use (Statistics Canada 2005b) (see Table 4.1) are available and suitable for estimating risks of victimization in different activities. Both surveys apply to populations 15 years and older, with the victimization survey conducted in 2004 and the time use survey carried out in 2005.

Similar to challenges reported by Lemieux (2010), the process of matching activity categories for victimization and time use in Canada was not automatic. For example, victimization categories are not easily matched with some time use categories, such as visitors to commercial or office buildings, stores or malls, hospitals, or prisons. Details about public places differed somewhat for numerator and denominator across the two data files. For example, in comparison to Lemieux (2010), we were unable to distinguish risk at school from

risk going to and from school, and to separate risk at bars from risk at restaurants. Although both victimization and time use surveys offered subcategories for outdoors and public places, these subcategories were incongruous. Combining all such time use activities would lead to less useful risk estimates for streets and public places. As a result, we matched the numerator and denominator for risks at home, in a street or public place at the workplace, at school, at a restaurant or bar, or in a private residence other than the respondent's own. It should be noted that a perfect match between numerator and denominator definitions would be best achieved by developing a simple survey asking both crime and time questions. However, it is difficult for such a survey to contain plentiful details on both crime and time. In the current study, we have gained the extra detail from independent crime and time studies, then gained a close (but not perfect) match in activity categories. That allowed practical calculations of time-based rates. Final calculations resulted in six matched categories of victimization and time use data.

The GSS victimization wave (Statistics Canada 2005a) offered a very useful distinction not found in the US data, opening the possibility of improving our understanding of home-linked victimizations. Although many Canadian victimizations occur in or near home, the Canadian survey probed further, distinguishing whether a victimization occurred *within* the home or apartment itself or in locations near home but not inside. For example, 70% of home victimizations occurred external to the home itself; that is, they occurred in the driveway, parking lot, shared areas, hallway, or in the laundry. This is a new and unheralded finding for the victimization literature. Unfortunately, we were unable to find suitable denominator data to explore these risks in terms of time spent in more specific home locations. With the lack of clear linkage between specific crime types and the location of these events, we elected to use all self-reported victimization from the GSS in Canada as the numerator.

Australia

Calculating activity-based crime rates in Australia resulted in many of the same challenges as highlighted in the USA and Canada. Assault victimizations were linked to time use, after making compromises to match categories. The crime data utilized for the numerator in the activity-based calculations was extracted from the assaults category from the 2005 Australian Bureau of Statistics (ABS) household survey of crime and safety (Australian Bureau of Statistics 2006) (see Table 12, page 23). Assault victimizations occurring in 2005 were harmonized with time use categories based on the time use survey of 2006 (Australian Bureau of Statistics 2008) (see Table 18). The Australian time use survey captured the amount of time spent in commercial and service places, while the victim survey differentiated incidents occurring at shopping centers. We reconciled these categories by combining each survey's commercial category with other places, so the larger categories are approximately similar. The time use survey distinguished time spent at work or school, while the victim survey combined these incidents into a single category. Therefore, we combined the time spent in both situations to calculate our exposure to risk rates. The victim survey distinguished incidents occurring in a private vehicle, public transit vehicle, or transit stations, versus street or open land. We were forced to combine these into a single public area category to reconcile victim data with the time use categories. While the time use survey separated time spent in entertainment places for leisure, culture, and sports from time spent in eating and drinking establishments, the victim survey failed to make that distinction. We subsumed these incidents within a single category.

The Australian time use statistics disaggregate time spent with persons of different relationships as well as the locations of those activities (Australian Bureau of Statistics 2008). This

disaggregation allows us to estimate the predominant exposure to risk and avoid multiple counts. If the reader is willing to assume that the greatest exposure to risk from partners occurs at home, the time survey indicates that 105 h per week is the period of risk. If the reader is willing to assume that the greatest exposure to risk from other family members occurs during time visiting them in their own residences, then it would mean that there are 10 h of exposure. Time with colleagues, neighbors, and friends was estimated by combining 40.5 h spent at work with colleagues with 7.5 h per week spent at the homes of friends, for a total of 48-h exposure. Finally, we focused on the five hours per week spent with crowds or unknown others in public places, expecting these to be the riskiest hours for assaults at the hands of strangers.[2] These estimates total to 168 h per week. The estimation process combined time survey data with a priori assumptions about victimization risk, while neglecting risks in some less obvious settings that are not completely secure. This not only overlooks time spent in other activities and places but also neglects the overlap between time spent with partners and time spent with other family members residing with the respondent.

ABS also reported victim-offender relationships for crimes reported to police, providing the opportunity to link time use to officially reported crime incidents. The ABS police-report data disaggregated by offender-victim relationship were reported for 2008 (Australian Bureau of Statistics 2009), while the time use data were measured in 2006. These risk estimates also depend on the reader's willingness to accept this 2-year time lag.

Results

Activity-Based Victimization Risk in the USA

Table 1 presents basic findings of activity-based crime rates in the USA. Referring to Table 1, based on the percent of victimizations at each location or activity (column A), activities at home appear to be riskiest, followed by leisure away from home, then workplace risk. Going to or from school or work appear to be relatively safe in comparison to the other activities. A different impression emerges from activity-based rates. Commuting to and from school becomes by far the riskiest activity, considerably riskier than attending school itself. Going to and from work becomes much riskier than being at the workplace.

Different risk patterns emerge when activity-based rates are examined (column B). Looking at the rank order of risk (neglecting time spent in each activity), "going to and from school" is the least risky and "other activities at home" produce the greatest risk of violent attack. Activity-based rates reverse this result, with going to and from school the riskiest activity hour-for-hour, while home activities become the least risky. Without considering time, work activity is riskier than the trip to work, while school activity is riskier than the trip to school.

Activity-based rates reverse this finding, with the trip to work becoming more dangerous than work itself, and the trip to school more dangerous than school itself. Hour-for-hour, sleeping at home is very secure, while attending school and trips away from home become very risky. Time spent going to and from school becomes 24 times as risky as home activities. The importance of time spent in transit is especially evident in activity-based rates of violent victimization. Although twice as many victimizations occurred attending school as on the way to or from school, activity-based rates reverse that effect. Time spent going to and from school

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[2] This neglects attacks inside drinking establishments. However, nightlife risks often occur in street locations.

Table 1 Violent victimization risk, USA, 2003–2005, comparison of activity-based rates to distribution by time

	(A) Percent of victimizations in each activity	(B) Violent victimizations per billion person-hours of participation
Activities at home (other than sleeping)	25.8	1804
Leisure away from home	23.2	8607
Working or on duty	18.3	3010
To or from other activities	9.1	5807
Attending school	8.6	6728
Shopping or errands	4.7	2727
To or from work	4.2	9009
To or from school	3.6	43,554
Sleeping	2.4	153
Totals	100.0	81,399

Incidents include rape, sexual attack, completed robbery, attempted robbery, aggravated assault, assault, unwanted sexual contact, and verbal threat of assault

Source: NCVS Incident-Level Extract Files, and ATUS Activity Summary Files

is more than seven times riskier than time spent at school itself. A strong reversal is also observed for time at work versus time going to and from work.

Activity-Based Victimization Risk in Canada

Drawn from the GSS victimization (Statistics Canada 2005a) (see pages 637–640) and time use surveys (Statistics Canada 2005b) (see Table 4.1), Table 2 compares activity-based rates to the distribution of victimization risk by time in Canada. Highlighted in column A, almost half of violent victimizations occurred under the category "respondent's home." In descending order of victimization risk, measured using activity-based rates, are streets or public places, workplaces, schools, restaurants or bars, and private residences other than one's own.

However, as shown in column B in Table 2, the calculation of victimizations per billion person-hours in each setting gives an entirely different impression. The respondent's home becomes the safest place to be, hour-for-hour. Restaurants or bars, which include less than 6% of victimizations, have the highest risk on an hour-for-hour basis. This risk is greater than the activity-based risk at home, a reversal of the impression given by the percentage distribution

Table 2 Comparison of activity-based rates to the distribution of victimization risk by time, Canada, 2004–2005

	(A) Percent of victimizations in each setting	(B) Victimizations per billion person-hours in each setting
Respondent's home	46.5	19,757
Street or public place	19.9	102,203
At work	14.6	38,749
School	7.4	177,168
Restaurant or bar	5.8	207,776
Other private residence	5.8	41,877
Totals	100.0	587,530

Incidents include sexual assault, robbery, and physical assault

Source: Statistics Canada, General Social Survey

alone. Activity-based rates also indicate considerably greater risk at school than the percent of victimizations implies. For example, the risk at work is much less hour-for-hour than the percentage distribution indicated. Another reversal is the relative risk of one's own home compared with someone else's residence. One's own home is eight times riskier than someone else's private residence, until we look at activity-based rates, which show another private residence to be twice as risky. Despite the limitations of the Canadian rate calculations, discussed above, new patterns in victimization rates emerge that shed new light on the way we assess the risks of victimization across six unique activities.

Activity-Based Victimization Risk in Australia

The results of activity-based rates to the distribution of assault victimization risk by time in Australia are presented in Table 3. The percentages of victimizations alone tell us that one's own house is the most dangerous place for assault, followed by school and work (combined category), public areas, leisure and entertainment areas (another combined category), someone else's house, and commercial locations. The activity-based rates give an entirely different impression of assault risk. Hour-for-hour, the safest place to be is one's own house. The least safety is found in leisure and entertainment settings, which is almost 14 times riskier than one's own house on an hour-for-hour basis. From a percentage viewpoint, being in one's own house is more than four times riskier than being in someone else's house. However, activity-based rates tell us that assault risk is almost five times greater in someone else's house than in one's own.

The Australian data on time spent with persons of different relationships highlights the complexities of how people move between groups, have varied relationships, and venture into locations that expose them to unknown individuals. For example, although there are only 168 h in a week, time spent with persons of various relationships totals over 380 h per week due to multiple counting. This is explained by the fact that much of the time spent with one's partner is also spent with other family members, and that friends or other relatives may be present during parts of that period. Similarly, trips away from home expose individuals to non-family members, yet they may also be accompanied by family members as well as friends. Thus, double and triple counting becomes a problem.

Table 3 Comparison of activity-based rates to the distribution of assault victimization risk by time, Australia, 2005–2006

	(A) Percent of assault victimizations in each setting	(B) Assault victimizations per billion person-hours in each setting
Own house	31.0	2432
Place of work or study	25.8	10,146
Public area	18.4	15,960
Leisure, entertainment	13.3	33,362
Someone else's house	6.9	11,859
Commercial, service, and other	4.6	6777
Total	100	80,536

Incidents include assault (including sexual assault for persons aged 18 years and over)

Source: ABS Household Survey of Crime and Safety, and ABS Time Use Survey

Table 4 presents the results comparing activity-based assault rates to the distribution of rates by time according to the victim-offender relationship. Referring to Table 4, it is seen that six-in-ten victimizations are committed by a known assailant. The activity-standardized rates reverse the results once more. Hour-for-hour, proximity to strangers is 78 times riskier than proximity to partners, and almost six times riskier than time spent with other family members. Although more than one-third of assaults were committed by known non-family members, the risks per billion person-hours are less than one-tenth of all stranger victimizations. From this example, we learn that activity-based rates can be applied to both victim survey data and police data. We also learn that victim-offender relationship data would be more useful with additional data about the proximity of other persons and the relationships to those persons. Further cross-tabulations of victimization surveys might provide numerators more easily matched to time use data found in the Australian survey. A summary of the similarities and differences in the type of victimization and time use activities analyzed, as well as the activity-based rates, across the three nations, is presented in Table 5.

Discussion

The Promising Potential of Activity-Based Rates

The current study was undertaken with two objectives. First, we highlighted the importance of/ need for activity-based measures to understand the patterns of crime victimization more accurately. Findings indicated that activity-based rates can alter, and at times, reverse our impressions about risk of crime victimization. This was true for both specific comparisons (such as risk of assault by relationship to assailant) and more general comparisons (such as risk at school vs. on the way to or from school). These calculations often revealed dramatically high risk in certain categories of activity or time allocation. Major reversals in the crime risk depiction occurred for the USA, Canada, and Australia. These risks are consistent with the finding that crime is highly concentrated in time and space, and that such concentrations merit more focused policy efforts at crime control and design against crime.

A second important finding related to the first objective is the impact of leisure, travel, and other activities outside the home on victimization per participation hours. The duration potential victims spend in community settings has a marked impact on the likelihood for victimization, particularly those that are correlated with community settings (e.g., assaults near drinking establishments). With a variety of public settings likely to generate quantities of crime

Table 4 Comparison of activity-based assault rates to the distribution of rates by time, by victim-offender relationship, Australia, 2008

Victim-offender relationships	(A) Percent of victimizations	(B) Rate per billion person-hours
Partner at home	10.7	131
Other family members	13.9	1792
Known non-family member	35.6	954
Stranger	39.8	10,264
Totals	100.0	13,141

Incidents include assault (including sexual assault for persons aged 18 years and over)

Source: ABS, Recorded Crime – Victims

Table 5 Summary of the similarities and differences in type of victimization, time use activities, and activity-based rates across the USA, Canada, and Australia

Country	Victimization survey categories used	Time use survey data used	Final activity-based rate in billion person hours
USA	Violent victimization, including completed rape; attempted rape; sexual assault with serious assault; sexual assault with minor assault; completed robbery with injury from serious assault; completed robbery with injury from minor assault; completed robbery without injury from minor assault; attempted robbery with injury from serious assault; attempted robbery with injury from minor assault; attempted robbery without injury; completed aggravated assault with injury; attempted aggravated assault with weapon; threatened assault with weapon; simple assault completed with injury; sexual assault without injury; unwanted sexual contact without force; assault without weapon without injury; verbal threat of rape; verbal threat of sexual assault; verbal threat of assault	Activities at home (other than sleeping)	1804
		Leisure away from home	8607
		Working or on duty	3010
		To or from other activities	5807
		Attending school	6728
		Shopping or errands	2727
		To or from work	9009
		To or from school	43,554
		Sleeping	153
CAN	All victimization, including sexual assault; robbery; attempted robbery; assault; break and enter; attempted break and enter; motor vehicle theft; theft of personal property, attempted theft of personal property, theft of household property, attempted theft of household property, vandalism, unclassifiable	Respondent's home	19,757
		Street or public place	102,203
		At work	38,749
		School	177,168
		Restaurant or bar	207,776
		Other private residence	41,877
AUS	Assault victimization	Own house	2432
		Place of work or study	10,146
		Public area	15,960
		Leisure, entertainment	33,362
		Someone else's house	11,859
		Commercial, service, and other	6777

(Felson and Eckert 2018), it is vital to highlight the fact that how a population interacts with these settings (e.g., either for leisure or work) will not be homogenous. In this case, subgroups of the population who spend more time away from home may be at an increased risk for victimization (e.g., young adults commuting to/from school) in comparison to others.

The importance of activity-based information in informing how crime is conceptualized has potential crime prevention implications for criminal justice stakeholders. For instance, alternative rates can justifiably be considered for policing decisions. First, police might consider sheer counts of problems and then respond accordingly. Second, police might feel they need to

respond to population-based crime rates, since citizens and public officials often resonate with these numbers. Third, police can focus on crimes per hectare (or other unit of space) since danger is often experienced in spatial and locational terms. Fourth, police can pay attention to repeat victimization as a means of allocating scarce policing resources. Last (but not least), police can focus attention on time-based rates, giving activities and locations extra attention if they experience high crime rates per billion person-hours exposed to risk. An important example of time-based thinking is found in Gottfredson et al. (2001), where juvenile delinquency risk was allocated to before school, during school, after school, and other periods. Risks were time-standardized, thus sharpening our understanding of what prevention efforts were needed and when. Arguably, all five approaches to rates are justifiable in rounding the picture of how to think about crime risk and ways to respond to it.

The same five alternatives are present for problem-oriented approaches, including situational crime prevention and designing out crime (i.e., Crime Prevention Through Environmental Design (CPTED)). This latter approach has specifically been shown to be useful in public settings (Iqbal and Ceccato 2016) and along transportation lines (La Vigne 1996) to reduce crime and potential victimization. Thus, the findings of this study can help pinpoint the types of *physical* locations where high-risk activities for victimization take place that would benefit most from tools such as situational crime prevention and CPTED. The implementation and/or continual refinement of these crime prevention techniques in community settings in combination with basic public awareness of the increased likelihood of victimization in public settings (while controlling for exposure time) represents a multifaceted policy approach that is likely to be beneficial in the three countries analyzed in this study.

Challenges of Using Activity-Based Rates to Study Victimization

The second objective of this study was to better understand how crime victimization varies across jurisdictions as a result of using activity-based rates in person hours. In reference to specific comparisons between each country, there are several points worthy of further discussion. Returning to definitional concerns, we found that both the Canadian and US calculations are not directly comparable. For example, the Canadian study separates risk at a restaurant or bar, while the US data only look at the larger category, "leisure activities away from home." Neither country enables us to estimate activity-based risk in drinking establishments clearly distinguished from other leisure activities away from home. The US data provide the extremely important distinction between being at school versus time spent going to and from school, a distinction absent from the Canadian data. The victim survey and time use survey were not calibrated in either nation to make location-based risk calculations automatic.

We cannot simply compare Tables 1 and 2 to ascertain relative risks in the two nations. The US data refer to violent victimizations, while the Canadian source data subsumes violent victimizations into a larger definition of incidents. The US data separate school itself from the journey to and from school, while the Canadian data combine these. The US data subsume restaurant and bar exposures under a larger category for leisure away from home. The two countries differ in their inclusions for work activities and locations. Despite these differences, data from both nations, respectively, tell us that activities in public places are quite a bit riskier, hour-for-hour, than staying at home. Moreover, results from both countries (along with Australia) highlight the importance of precision for both numerator and denominator sources and for improving the ability to match them and compare to other nations.

Unlike the Canadian data, the Australian data include victimizations in car parks with the recreation category. The Australian data consider only the location of the most recent assault incident, while the Canadian numbers were drawn from incident reports more broadly defined. Despite our initial objective, the different incident data and time use variables collected across countries precluded our ability to make *direct* interjurisdictional comparisons. Nonetheless, calculations from all three nations tell us that activity-based rates give a different perspective and that risks away from home are especially highlighted by these calculations.

It is important to note that in light of the methodological problems described above, recent research has highlighted the utility of using space-time budgets and electronic time use diaries to overcome many of these challenges (Elevelt et al. 2019; Ruiter and Bernasco 2018; Wikström et al. 2012). By recording activities, time spent in locations/doing things, and recording victimization and/or offending information, much of the "matching" data issues are no longer a problem. Continued use of such approaches for studying victimization patterns may pave a more promising path for future research.

Conclusions

Victimization researchers have long been aware that victim-offender relationships are important and victim surveys have repeatedly asked about it. Both victim surveys and police data pay attention to this issue. However, we know of no effort to standardize rates for time spent with persons of different relationships. This task is not straightforward, since people move about in groups with various relationship mixes and pass through areas where they are exposed to strangers, even though non-strangers are also present. This study should be viewed as part of a larger literature demonstrating the utility of alternative and more focused denominators that seek a more nuanced and more precise depiction of how risk of crime varies.

Implications

The findings from this study have important implications. First, they highlight the types of activities and settings that put individuals at the highest risk of victimization, which can allow for more specific crime prevention measures to be put into place. For example, the policy implications of more focused risk calculations are exemplified by returning to the work of Lemieux and Felson (2012). It was clear from that research, as well as the findings of the current study, that the riskiest activity domain, hour-for-hour, was the journey to and from school. That has quite pointed implications for police patrol, security on school grounds and nearby locations both before and after school, as well as decisions about transportation of youths to and from school. Such knowledge should be disseminated on a larger scale so that the actual risk of victimization versus individuals' perception of risk in various activities/ contexts can be more accurately matched (Lemieux 2010). This is important so that individuals are more aware of the types of activities and contexts in which they should have heightened awareness of potential victimization, and as such be more prepared to engage in the appropriate self-protective measures to reduce this risk. Second, calculating activity-based risk in different countries may help policymakers consider crime prevention from a slightly different lens to refine existing policies and procedures to be even more effective at minimizing victimization. By starting with a list of broad activities/events which are known to increase the risk of victimization, policymakers can elect the way that they will respond to the needs of

their respective communities. For example, they may elect to disaggregate risky activities by subgroups of the population (e.g., age/gender), or during specific time periods, to create or amend existing crime prevention techniques. Indeed, crime "prevention techniques [...] are likely to be far more effective if focused on short periods that generate the greatest risk hour for hour" (Lemieux and Felson 2012, p. 650). Alternatively, policymakers may wish to prevent crime in their jurisdictions through less granular initiatives where the focus is more on preventing victimization that is associated with a broad range of activities (e.g., going to work). A seemingly obvious reason for using a less-specific approach would be for financial reasons in that, although more general crime prevention activities may be less effective at reducing victimization, they will not be as labor-intensive as their time/place-specific counterparts.

Limitations and Future Research

Some limitations are present in the current study. As has been explained at length by previous researchers (Lemieux 2010), the nature of the data used has inherent limitations. Pertinent to the current study is the fact that numerator and denominator data for all three countries may not represent the actual number of crimes and/or precious measures of activities. Although this accuracy was never the primary intention of this study, we do recognize these data issues, nevertheless. One method to reduce this limitation would be to combine time use and crime victimization within the same survey. Relatedly, a second limitation is that the data used in the current study are still aggregate measures of victimization and time use. Different patterns may emerge when victimization measures and exposure to risk in different activities are disaggregated further by sociodemographic variables, for example. A final limitation is the cross-jurisdictional nature of the paper itself. Data for victimization needed to be matched (within reason) to available time use data. By using comprehensive government-administered, population-level surveys, there may be a considerable time lag between those made available within the same jurisdiction, let alone between countries. Ideally, a cross-national comparison of time-based crime rates would use the same activity categories—not only for numerators and denominators but also from one nation to another. The current paper can only be a stepping stone on the way towards an ideal comparative paper in the future. However, we were able to show that different nationals display strong risk variations based on routine activities, and that activities away from home or in general most likely to generate risk of violent victimization, on an hour-for-hour basis.

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